A65832

WJ-1204

SIMPLIFIED OPERATION PROCEDURES

INSTRUMENT SHOP

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SIMPLIFIED OPERATION OF THE WJ-1204

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SIMPLIFIED OPERATION OF THE WJ-1204

CW SIGNAL GENERATION

1. Set controls as follows:

MODULATION	$\boxed{\text{OFF}}$
MODE	$\boxed{\text{F}}$
PROGRAM/DISPLAY	$\boxed{\text{F}}$
Power Meter Select	$\boxed{\text{INT}}$

2. Enter desired frequency in GHz as follows:

Example	Steps	Display
100 MHz	$\boxed{.}$ $\boxed{1}$ $\boxed{\text{ENT}}$	.10000
825.1 MHz	$\boxed{.}$ $\boxed{8}$ $\boxed{2}$ $\boxed{5}$ $\boxed{1}$ $\boxed{\text{ENT}}$	.82510
6.283 GHz	$\boxed{6}$ $\boxed{.}$ $\boxed{2}$ $\boxed{8}$ $\boxed{3}$ $\boxed{\text{ENT}}$	6.2830
18.748 GHz	$\boxed{1}$ $\boxed{8}$ $\boxed{.}$ $\boxed{7}$ $\boxed{4}$ $\boxed{8}$ $\boxed{\text{ENT}}$	18.748

Response to Improper Command

If an improper command is entered, for example, 27.628 GHz

$\boxed{2}$ $\boxed{7}$ $\boxed{.}$ $\boxed{6}$ $\boxed{2}$ $\boxed{8}$ $\boxed{\text{ENT}}$

the Display 27.628 will blink and the output frequency will remain at its previous acceptable setting. To clear the improper command, enter $\boxed{\text{CLR}}$.
The display will now show the actual output frequency.

3. Adjust output power level; the output power level is the sum of the RF POWER (dBm) LED readout and the ATTENTUATION (dB) setting:

Example

RF POWER (dBm)	ATTENUATION (dB)	OUTPUT LEVEL (dBm
+03.4	30	-26.6
+00.0	20	-20.0
05.5	80	-85.5

Set desired output level by turning LEVEL control clockwise to increase power. (If the UNLEVELED indicator is off, the output level is being maintained at a constant value.) Before making power measurements, press CAL to automatically recalibrate the power meter.

CAUTION

Do not press the CAL button while the 1204 is sweeping.

INTERNAL FIXED 1 kHz PULSE OR SQUARE WAVE MODULATION

1. Set controls as follows:

MODULATION	SQUARE or PULSE
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency (see Step 2 of CW Signal Generation on page 1).

3. Set desired PULSE WIDTH (us) on thumbwheel switch. (Not necessary if SQUARE is set.)

4. 1 kHz square wave sync signal is available from the SYNC OUT connector to use for scope synchronization.

5. Adjust/measure power:

   To set output level, the LEVEL control and attenuator are used as shown in CW Signal Generation. NOTE THAT THE OUTPUT SIGNAL IS NOT LEVELED WHEN THE SQUARE, PULSE, OR EXT BUTTONS ARE PRESSED. The RF POWER (dBm) level of the "on" portion of the square wave or pulse is measured by pressing the Power Meter Select to MOD. If the LED readout is below - 10 dBm, adjust ATTENUATION clockwise one step at a time and turn the LEVEL control clockwise until the power meter reads between -10 dBm and +0 dBm.

EXTERNAL PULSE OR SQUARE WAVE MODULATION

1. Set controls as follows:

MODULATION	EXT
MODE	F
PROGRAM/DISPLAY	F
Power Meter Display	INT

2. Enter desired frequency (see CW Signal Generation on page 1).

3. Connect external modulation input to MOD IN connector. An input level of 0 to +0.8 volts will hold the RF output off. An input level of +2.0 to +5.5 volts will turn the RF on. Be sure not to exceed a peak input level of +5.5 volts. Note that linear modulation is not accepted by the 1204.

4. Adjust/Measure Power:

   To set output level, the LEVEL control and attenuator are used as shown in CW Signal Generation. NOTE THAT THE OUTPUT SIGNAL IS NOT LEVELED WHEN THE SQUARE, PULSE, OR EXT BUTTONS ARE PRESSED. The RF POWER (dBm) level of the "on" portion of the square wave or pulse is measured by pressing the Power Meter Select to MOD. If the LED readout is below -10 dBm, adjust ATTENUATION clockwise one step at a time and turn the LEVEL control clockwise until the power meter reads between -10 dBm and +0 dBm.

GENERATE CW STEP SWEEP

1. Set controls as follows:

MODULATION	$\boxed{\text{OFF}}$
MODE	$\boxed{\text{F}}$
PROGRAM/DISPLAY	$\boxed{\text{F}}$
Power Meter Select	$\boxed{\text{INT}}$

2. Enter desired start/stop sweep frequency:

Set PROGRAM/DISPLAY to $\boxed{\text{START}}$.

Enter start frequency - for example, 2.304 GHz:

$\boxed{2}\ \boxed{.}\ \boxed{3}\ \boxed{0}\ \boxed{4}\ \boxed{\text{ENT}}$

Display will show 2.3040

Note that the generator will not be generating 2.3040 GHz, but will have remained at its original frequency.

Set PROGRAM/DISPLAY to $\boxed{\text{STOP}}$.

Enter stop frequency - for example, 4.829 GHz.

$\boxed{4}\ \boxed{.}\ \boxed{8}\ \boxed{2}\ \boxed{9}\ \boxed{\text{ENT}}$

Display will show 4.8290.

Set PROGRAM/DISPLAY TO $\boxed{\text{F}}$.

3. Set desired sweep INCREMENT (step size):

Select $\boxed{\text{1 MHz}}$ or $\boxed{\text{10 MHz}}$ or $\boxed{\text{100 MHz}}$.

For sweep ranges completely below 2.00 GHz, increments of 100 kHz can be selected by setting all three INCREMENT pushbuttons to the out position.

4. Adjust the output power level as shown under CW Signal Generation on page 1.

CAUTION

Do not press CAL while the 1204 is sweeping.

5. Sweep: Set MODE to SWEEP.

6. To change sweep INCREMENT, select another INCREMENT. This may be done while the unit is sweeping.

7. To change sweep start/stop:

   Set MODE to F, set PROGRAM/DISPLAY to START.
   Enter new START frequency.

   Set PROGRAM/DISPLAY to STOP.

   Enter new STOP frequency.

   Set PROGRAM/DISPLAY to F, set MODE to SWEEP.

8. To sweep across relay switching point; (the 1204 is programmed so that it will not automatically sweep through 1, 2, 8, 13, and 18 GHz. This is to prevent accidental damage of the relays).

   The sweep START and STOP frequencies can be set to go through any or all of these switching points. The 1204 will sweep until it reaches a relay switching point and the FREQUENCY display will blink. To override the program and allow the sweep to continue, press ENT.

9. To stop the sweep, set MODE to F or F ±ΔF. If the 1204 was sweeping down, full output power may not be available. To obtain . . . ENT (see #5 on page 6.).

10. To resume sweeping

    a. without going back to the START frequency, set MODE to SWEEP.

    b. from the START frequency, press RST. Set MODE to SWEEP.

NOTE

The 1204 may be swept as described above while internal or external modulation is operating. When so operated, the output power will not be levelled.

UP/DOWN FREQUENCY MANUAL STEP OR SLEW

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency (as in CW Signal Generation on page 1).

   Note that the frequency of operation could have been reached by setting MODE to F from SWEEP, that is, by stopping the sweep.

3. Select step INCREMENT:

   1 MHz, 10 MHz, or 100 MHz may be selected. Below 2.000 GHz, 100-kHz steps can be selected by setting all three INCREMENT buttons out.

4. Step or Slew UP:

   To increase the RF frequency by one step, press and release UP. To slew the RF frequency higher press and hold UP. The frequency will move up one step, pause, and then step higher in frequency at the same rate as if the unit were sweeping.

5. Step or Slew Down:

   Single steps or frequency slew to a lower RF frequency can be obtained by using DWN. To obtain full 1204 output power at the frequency to which the 1204 has stepped re-enter the frequency. For example if a DWN slew is stopped at 8.279 GHz, full power can be obtained by entering:

   8 . 2 7 9 ENT .

   Note that sweeps acros relay switch points over part or all of the 0.1 GHz to 16 GHz range can be obtained manually by using UP or DWN.

NARROWBAND CONTINUOUS SWEEP (F ±ΔF)

1. Set controls as follows:

MODULATION	OFF
MODE	F ±ΔF
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency as shown under CW Signal Generation on page 1.

3. Adjust sweep width:

   Turn ΔF clockwise until desired sweep width is obtained. The output signal is sweeping at a 1-kHz rate above and below the phase-locked center frequency displayed on the LED readout.

4. Manual stepping of narrowband continuous swept signal:

   The narrowband swept signal may be stepped manually over any or all of the 0.1 to 26 GHz band using UP or DWN. See paragraph 7 on page 6 regarding output power.

MEASUREMENT OF EXTERNAL RF POWER

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	EXT

2. Connect external signal to EXT RF IN. Do not exceed +15 dBm (31.6 mW).

3. Enter approximate frequency of external signal as covered under CW Signal Generation (page 1). This assures best accuracy in making external power readings by using the power meter correction factors contained in the memory of the 1204.

MEASUREMENT OF INSERTION LOSS OR GAIN

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Set ATTENUATION (dB):

   For insertion loss measurements of cables, filters, attenuators, etc., set to 0 dB.

   For amplifier gain measurements, set ATTENUATION value so that the amplifier output level will fall within +10 dBm to -30 dBm.

   Be sure to set input level low enough so that the amplifier will not be saturated.

3. Set desired frequency as covered under CW Signal Generation on page 1.

4. Set LEVEL to 0.00 dBm.

5. Connect unit to be tested between the RF OUT and EXT RF IN connectors. Be especially careful about cable lengths and quality above 12 GHz.

6. Measure unit's loss (or gain):

   Set Power Meter Select to EXT. LED reading indicates the unit's loss (for example, -21.4 indicates that the unit under test has a loss of 21.4 dB). If the LED reading is -30.0 dBm or lower, set the Power Meter Select to INT. Adjust LEVEL control clockwise to increase the signal into the unit under test. Read the LEVEL (+4.7 dBm, for example). Set the Power Meter Select to EXT. Read the level (-27.4 dBm, for example, indicates the unit being tested has an insertion loss of 32.1 dB).

   CAUTION

   Be sure to CAL the meter. Do not sweep unit when measuring insertion loss or gain. The frequency may be raised or lowered one increment at a time by the UP or DWN control.

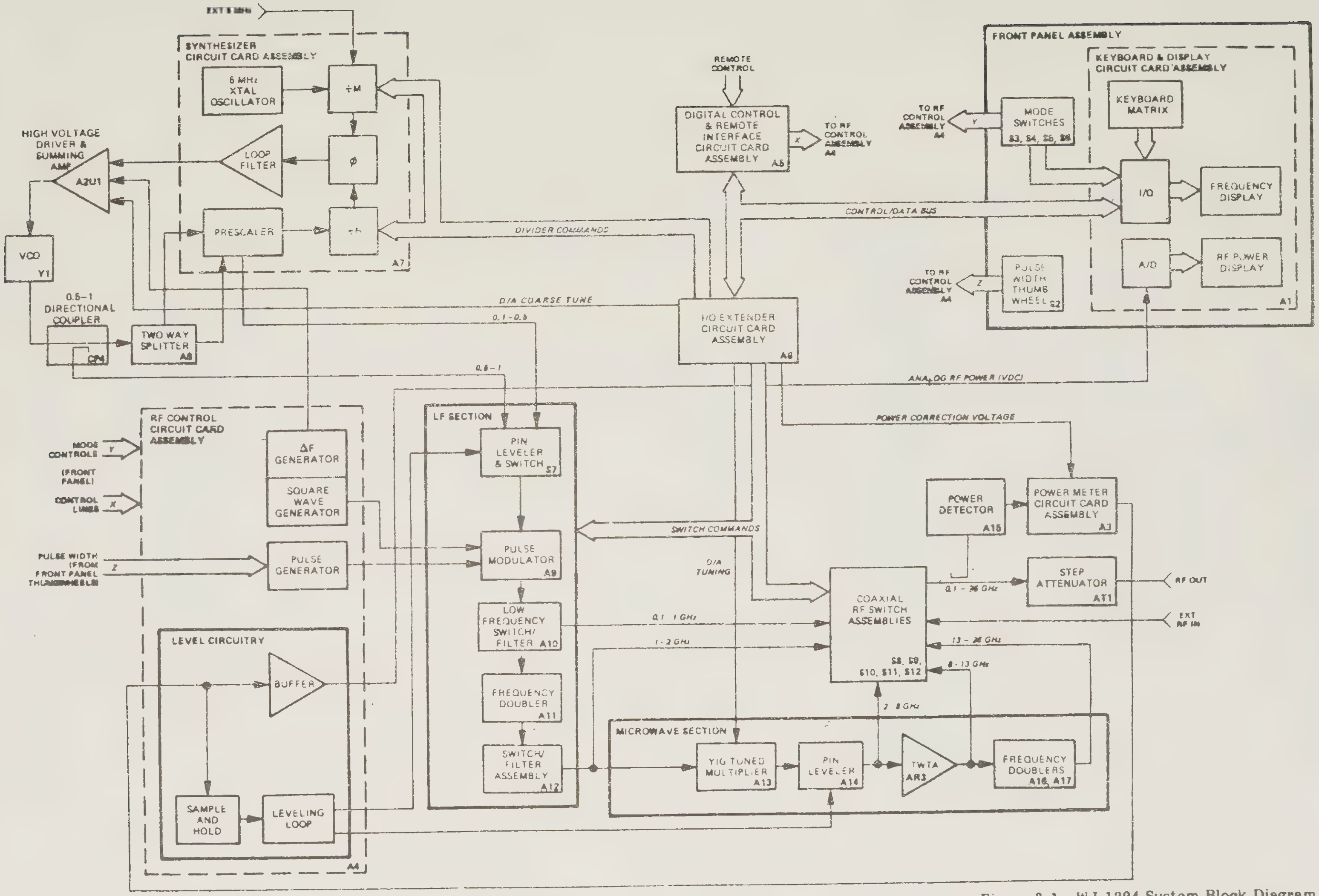

Figure 3-1. WJ-1204 System Block Diagram

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USERS NOTE

WJ-1204 SERIES

STANDARD BUS INTERFACE

INSTRUMENT SHOP

By

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Revised: March 1980

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USERS NOTE: WJ-1204 SERIES STANDARD BUS INTERFACE

1.0 INTRODUCTION

This Users Note is designed to aid the software and hardware development necessary to use the WJ-1204 Series Standard Bus Interface.

2.0 GENERAL DESCRIPTION

The WJ-1204 Series Standard Bus Interface is based on the precept that the WJ-1204 series unit is an addressable listener and talker, and the Controller, a computer, minicomputer, or calculator, is capable of controlling an HP-IB or IEEE 488-1975 compatible interface. The interface uses an eight bit Bus and three handshake lines; DAV, controlled by the talker, and NRFD and NDAC, controlled by the listener. Along with these lines is an attention (ATN) control line controlled by the controller which is used to define the state of the Data Bus. Several additional lines are available for use by the controller. Their meaning and use is discussed in IEEE Standard Digital Interface for Programmable Instrumentation (Number 488-1975).

Table 1 is an outline of the Interface I/O lines and their uses. Figure 1 is a Standard Bus Interface Connector.

2.1 Capabilities

This section describes the basic capabilities of the WJ-1204 Series Unit equipped with the Standard Bus Interface. All references are to the IEEE Standard Digital Interface for Programmable Instrumentation IEEE STD-488-1975.

2.1.1 Interface Subset Capability

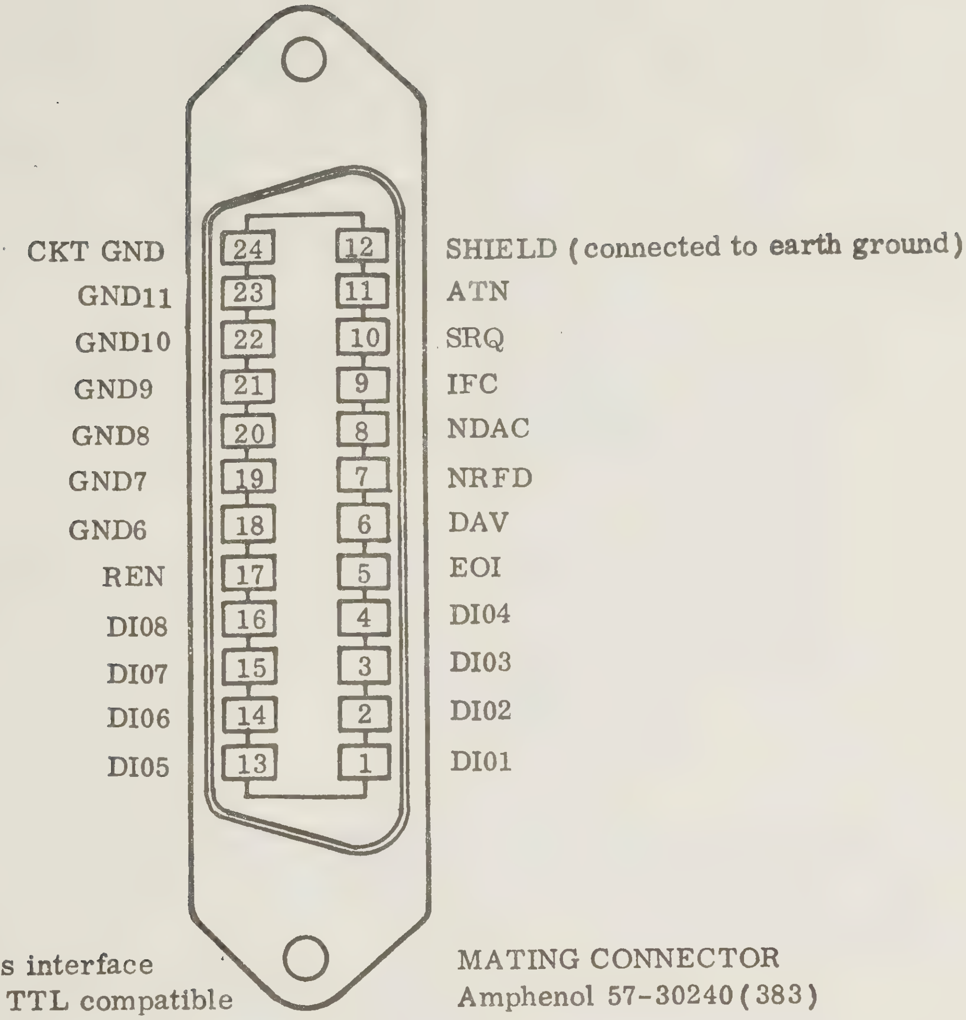
The Standard Bus Interface has the following subset capability as outlined in Appendix C of the IEEE 488-1975 standard and specified throughout the standard SH1, AH1, T6, TEO, L4, LEO, SRI, RLO, PPO, DCO, DT1 and CO.

TABLE I

STANDARD BUS INTERFACE INPUT/OUTPUT LINES

NAME	MEANING	CONTROLLING SOURCE	IDENTIFICATION/USE	COMMENTS
DI01	Data Input-Output One	Talker or controller	LSB of ASCII character	These lines are used for the general exchange of information in both command and data modes.
	↓	↓	↓	
DI07	Data Input-Output Seven	Talker or controller	MSB of ASCII character	
DI08	Data Input-Output Eight	Talker or controller	Parity check bit*	
DAV NRFD NDAC	Data Valid Not Ready for Data Not Data Accepted	Talker or controller Listener Listener	Data on DI01-8 is valid Listener is busy Listener has not yet accepted the data	These lines are used for asynchronous data transfer using the handshake sequence.
IFC	Interface Clear	Controller .	Unaddresses all talkers and listeners	Management control lines to govern the state and use of the interface bus.
ATN	Attention	Controller	When high-data mode When low--command mode	
SRQ	Service Request	Any unit on the interface bus	Set low when a unit requires servicing	
REN	Remote Enable	Controller	Must be low for the information on the interface bus to be valid.	
EOI	End or Identify	Talker or controller	Indicates the end of a multi-byte data transfer, also used in parallel polling**	

LSB	Least Significant Bit
MSB	Most Significant Bit
ASCII	American Standard Code for Information Interchange
Listener	A device capable of receiving data or commands from other instruments
Talker	A device capable of transmitting data to other instruments
Controller	A device capable of managing communications over the interface bus
*	The parity check bit is not recognized by the present interface board
**	The EOI line is not recognized or activated by the present interface board



The standard bus interface logic levels are TTL compatible (negative true)

MATING CONNECTOR
Amphenol 57-30240(383)

Figure 1 - Standard Bus Interface Connector Pin-Outs.

2.1.2 Talk/Listen Addresses

Both the talk and listen addresses for the WJ-1204 Series Units are manually programmable via a mini-dip switch located on the bottom of the mother board assembly. The WJ-1204 Synthesizer Mainframe is shipped with the talk address set at "S"* and the listen address set at "3"*. Note that only the 5 least significant bits of the character are used for the interface address. Therefore, both "S" and "3" translate to a decimal address of 19 (10011).

2.2 Unit Talk Characteristics

The WJ-1204 Synthesizer Mainframe has two talk modes which are important to central-operator-run test systems and to automatically controlled test systems. These are the Power Meter reading and Service Request for invalid frequencies.

2.2.1 Normal Talk

The Standard Bus Interface conveys the Power Meter reading, when told by the controller to talk, in 4 bytes of data (a string of 4 ASCII Characters).

1st Character	SIGN
2nd Character	10 dBm digit
3rd Character	1 dBm digit
4th Character	.1 dBm digit

The transmission is terminated with the EOI signal.

2.2.2 Serial Poll Talk

The Standard Bus Interface has the ability to respond to a serial poll by the system controller. This is done by the controller enabling a serial poll with the ASCII Character "CAN", in the Bus Command Mode, and addressing successive instruments on the Bus to talk. When addressed, the synthesizer will, if it has requested service by setting the SRQ line low, set DIO line 7 low. If it had not set SRQ low, DIO line 7 will be high. After a serial poll is complete, the synthesizer must be commanded to disable the serial poll with the ASCII Character "EM", in the Bus command mode. An attempt to program an invalid frequency is the only condition which will generate a SRQ by the WJ-1204.

---

*ASCII Character

2.3 Unit Listen Characteristics

The WJ-1204 has two listen functions which are used for remote control of the synthesizer frequency and power meter measurement.

2.3.1 Frequency Programming

The frequency programming command consists of a frequency specified in GHz followed by the ASCII Character "E". The EOI signal is not required.

Examples:

"21.34E"	21.34 GHz
"15E"	15 GHz
"0.12E"	.12 GHz
"5E"	5 GHz

WARNING:

> The synthesizer will not respond to any other commands until the "E" is received. Interruptions during the frequency programming function are not allowed.

2.3.2 Power Measurement

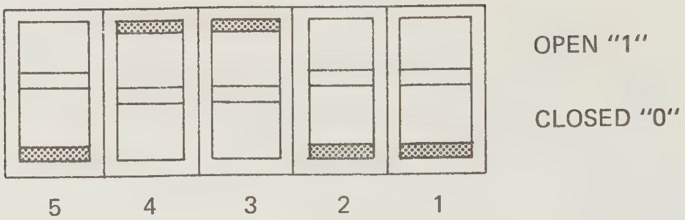
A power measurement is commanded by sending the ASCII Character "R". When the power meter is in the "EXT" mode a power measurement must be commanded when required. When in the "INT" mode, the power measurements are made automatically and the "R" command is not required.

3.0 Operation

The following paragraphs discuss the basic methods needed to control the WJ-1204 using the IEEE Standard Interface Bus.

3.1 Address Selection

The address select dip switch located on bottom of mother board must be set to desired IEEE device address. Open for binary 1, closed for binary 0.



The IEEE listen address "3" and talk address "S" are shown above.

3.2 Front Panel Controls

The modulation select switches, the power meter select switch, and the amplitude controls are not software controlled and should be selected before operating. Normally the modulation select will be set to the OFF position and the power meter will be set to INT. All frequency controls are inoperative in the remote mode. F ±ΔF is disabled and the Sweep Out ramp is not generated in the remote mode.

3.3 Local - Remote Selector

The LOC/REM selector switch located on rear panel near IEEE Bus connector must be placed in the REM (Remote) position for remote operation.

3.4 Initialization

The WJ-1204 can be initialized either through the power on sequence or by issuing an "IFC" command. The synthesizer is then ready to be programmed using an IEEE controller. If the WJ-1204 will not respond to remote commands (including "IFC"), switching from Remote to Local and back to Remote will re-initialize the system. This may be required if system operation is interrupted during a frequency programming function (Reference 2.3.1).

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WJ-1204 - 1

SIMPLIFIED OPERATION PROCEDURES

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SIMPLIFIED OPERATION OF THE WJ-1204

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PRELIMINARY SETUP

1. AC LINE SELECTOR (for units with Option AC)

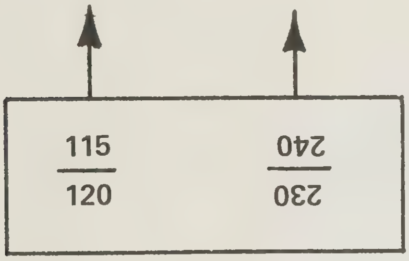
Remove ac line cord from WJ-1204 rear panel.

Slide plastic window to left.

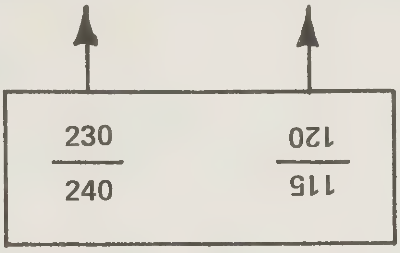
Extract fuse using black lever.

Remove ac line select circuit card (located below fuse compartment).

Position circuit as shown below and reinstall.



For 115 V ac Operation



For 230 V ac Operation
(Option AC only)

Check fuse and reinstall.

Slide plastic window to right.

Reinsert ac line cord.

2. REAR PANEL CONTROLS

5 MHz Reference	INT OUT
Local/Remote (Option AB)	LOC
Synthesizer (Option AF)	INT
External FM (Option AJ)	OFF

3. FRONT PANEL CONTROLS

Power	OFF
Modulation	OFF
Mode	F
Program/Display	F
Increment	1 MHz
Attenuation (dB)	10
Power Meter Select	INT
Level	MAX (CW)

WJ-1204 TURN ON PROCEDURE

1. Plug ac line cord into primary source of ac power.

2. Set POWER switch to ON.

3. Frequency display should read 1.0000 GHz.

   NOTE

   If display does not read 1.0000 GHz, press CLR.
   If display still does not read 1.0000 GHz, turn power OFF and then ON.

4. Allow 5 minutes warm up.

5. Verify that LEVEL control changes power display smoothly from at least +05.0 dBm to -10.0 dBm.

CW SIGNAL GENERATION

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency in GHz as follows:

Example	Steps	Display
100 MHz	. 1 ENT	.10000
825.1 MHz	. 8 2 5 1 ENT	.82510
6.283 GHz	6 . 2 8 3 ENT	6.2830
18.748 GHz	1 8 . 7 4 8 ENT	18.748

Response to Improper Command

If an improper command is entered, for example, 27.628 GHz

2 7 . 6 2 8 ENT

the Display 27.628 will blink and the output frequency will remain at its previous acceptable setting. To clear the improper command, enter CLR . The display will now show the actual output frequency.

3. Adjust output power level; the output power level is the sum of the RF POWER (dBm) LED readout and the ATTENTUATION (dB) setting. For example:

RF POWER (dBm)	ATTENUATION (dB)	OUTPUT LEVEL (dBm)
+03.4	30	-26.6
+00.0	20	-20.0
-05.5	80	-85.5

Set desired output level by turning LEVEL control clockwise to increase power. (If the UNLEVELED indicator is off, the output level is being maintained at a constant value.) Before making power measurements, press CAL to automatically recalibrate the power meter.

CAUTION

Do not press the CAL button while the 1204 is sweeping.

INTERNAL FIXED 1 kHz PULSE OR SQUARE WAVE MODULATION

1. Set controls as follows:

MODULATION	SQUARE or PULSE
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency (see Step 2 of CW Signal Generation).

3. Set desired PULSE WIDTH on thumbwheel switch. (Not necessary if SQUARE is set.)

4. 1 kHz square wave sync signal is available from the SYNC OUT connector to use for scope synchronization.

5. Adjust/measure power:

   To set output level, the LEVEL control and attenuator are used as shown in CW Signal Generation. NOTE THAT THE OUTPUT SIGNAL IS NOT LEVELED WHEN THE SQUARE, PULSE, OR EXT BUTTONS ARE PRESSED. The RF POWER (dBm) level of the "on" portion of the square wave or pulse is measured by pressing the Power Meter Select to MOD . If the LED readout is below - 10 dBm, adjust ATTENUATION clockwise one step at a time and turn the LEVEL control clockwise until the power meter reads between -10 dBm and +0 dBm.

EXTERNAL PULSE OR SQUARE WAVE MODULATION

1. Set controls as follows:

MODULATION	EXT
MODE	F
PROGRAM/DISPLAY	F
Power Meter Display	INT

2. Enter desired frequency (see CW Signal Generation).

3. Connect external modulation input to MOD IN connector. An input level of 0 to +0.8 volts will hold the RF output off. An input level of +2.0 to +5.5 volts will turn the RF on. Be sure not to exceed a peak input level of +5.5 volts. Note that linear modulation is not accepted by the 1204.

4. Adjust/Measure Power:

   To set output level, the LEVEL control and attenuator are used as shown in CW Signal Generation. NOTE THAT THE OUTPUT SIGNAL IS NOT LEVELED WHEN THE SQUARE, PULSE, OR EXT BUTTONS ARE PRESSED. The RF Power (dBm) level of the "on" portion of the square wave or pulse is measured by pressing the Power Meter Select to MOD. If the LED readout is below -10 dBm, adjust ATTENUATION clockwise one step at a time and turn the LEVEL control clockwise until the power meter reads between -10 dBm and +0 dBm.

MAXIMUM UNLEVELED OUTPUT POWER

1. Set controls as in paragraph 1 of External Pulse or Square Wave Modulation.
2. Do not connect anything to MOD IN jack.
3. Turn LEVEL control to MAX (clockwise).
4. Read RF power by pressing Power Meter Select to MOD.

NOTE

Instrument may be swept in this mode to obtain maximum (unleveled) RF output power at all frequencies.

SWEEP MODES

GENERATE CONTINUOUS CW STEP SWEEP

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired start/stop sweep frequency:

SWEEP UP: Start Frequency less than Stop Frequency
SWEEP DOWN: Start Frequency greater than Stop Frequency

Set PROGRAM/DISPLAY to START.

Enter Start Frequency - for example, 2.304 GHz:

2 . 3 0 4 ENT

Display will show 2.3040

Note that the generator will not be generating 2.3040 GHz, but will have remained at its original frequency.

Set PROGRAM/DISPLAY to STOP.

Enter Stop Frequency - for example, 4.829 GHz.

4 . 8 2 9 ENT

Display will show 4.8290.

Set PROGRAM/DISPLAY to F.

Display will show previously programmed output frequency.

3. Set desired sweep INCREMENT (step size):

Select 1 MHz or 10 MHz or 100 MHz.

For sweep ranges completely below 2.00 GHz, increments of 100 kHz can be selected by setting all three INCREMENT pushbuttons to the out position.

4. Adjust the output power level as shown under CW Signal Generation.

CAUTION

Do not press CAL while the 1204 is sweeping.

5. Sweep: Set MODE to SWEEP.

Unit will sweep from Start Frequency to Stop Frequency and then repeat until sweep is disabled.

6. To change sweep INCREMENT, select another INCREMENT. This may be done while the unit is sweeping.

7. To change sweep start/stop:

Set MODE to F, set PROGRAM/DISPLAY to START.

Enter new Start Frequency. (Be sure to press ENT.)

Set PROGRAM/DISPLAY to STOP.

Enter new Stop Frequency. (Be sure to press ENT.)

Set PROGRAM/DISPLAY to F, set MODE to SWEEP.

8. Sweep Delays

a. Relay switching points: The WJ-1204 contains electromechanical switches which route the RF signal to the RF OUT connector. Switching occurs at the following frequencies: 1, 2, 8, 13, and 18 GHz. The standard WJ-1204 is programmed so that the sweep will delay approximately 200 milliseconds at each of these frequencies. This is to allow time for the switching and for the RF leveling circuit to settle out before continuing the sweep.

NOTE: On some older versions, the sweep actually stops at each of these frequencies and the display flashes. To continue the sweep, press ENT. This option is still available from the factory on request.

b. Retrace: The WJ-1204 is provided with an 800 ms delay after the Stop Frequency is reached. This is to allow the system to reset to the Start Frequency and provide a Pen Lift output for use with a Chart Recorder.

c. Pin Diode Switching Points: At each of the following frequencies; 125, 160, 250, 400, 500, and 630 MHz, the sweep will delay for approximately 200 ms to allow switching of filters.

d. VCO retrace points: At 4 GHz and 16 GHz, the sweep will delay for approximately 200 ms to allow retrace of the fundamental VCO.

e. The WJ-1204 sweep limits (Start and Stop) may be selected to cover ALL or any part of the 100-MHz to 26-GHz frequency band. Aside from the retrace delay, the sweep will only pause at frequencies that are encompassed by the sweep limits.

NOTE: For special applications requiring greater or lesser delays, please consult the factory.

9. To stop the sweep, set MODE to F. If the 1204 was sweeping down, full output power may not be available. To obtain full output power, re-enter the displayed frequency. For example, if the sweep is stopped at 8.179 GHz, full output power may be obtained by pressing

8 . 1 7 9 ENT.

10. To resume sweeping

a. without going back to the Start Frequency, set MODE to SWEEP.

NOTE

If the frequency was changed by using the ENT button, the sweep will begin at the Start Frequency. If the frequency was changed using the UP or DWN slew buttons, the sweep will continue from its present frequency setting.

b. from the Start Frequency, press RST. Set MODE to SWEEP.

NOTE

The 1204 may be swept as described above while internal or external modulation is operating. When so operated, the output power will not be leveled.

GENERATE SINGLE SWEEP

1. Follow procedure outlined for CONTINUOUS SWEEP, paragraphs 1 through 4.

2. To start sweep: On keyboard press CLR and hold down while pressing 8. Buttons may be released in any order. DO NOT SET MODE SWITCH TO SWEEP. Unit will sweep once from the Start Frequency to the Stop Frequency, return to the Start Frequency and then stop.

3. Sweep will exhibit the same delays as described in CONTINUOUS SWEEP, Paragraph 8, with the following exception: when single sweeping down in frequency, there will be a delay of 200 ms between every frequency step.

4. Single sweep may be used in conjunction with F ± ΔF mode. Simply set MODE to F ± ΔF before initiating sweep. (see NARROWBAND CONTINUOUS SWEEP).

5. To stop sweep: Single sweep will stop itself after one sweep. To stop sweep sooner, set PROGRAM/DISPLAY to START or STOP position. Then return to F position. Output frequency will remain where it was when sweep was stopped.

NOTE

The single sweep always begins at the programmed Start Frequency.

CAUTION

Do not press CAL while the WJ-1204 is sweeping.

6. Sweep Increment: Same as for CONTINUOUS SWEEP.

UP/DOWN FREQUENCY MANUAL STEP OR SLEW

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency (as in CW Signal Generation).

   Note that the frequency of operation could have been reached by setting MODE to F from SWEEP, that is, by stopping the sweep.

3. Select step INCREMENT:

   1 MHz, 10 MHz, or 100 MHz may be selected. Below 2.000 GHz, 100-kHz steps can be selected by setting all three INCREMENT buttons out.

4. Step or Slew UP:

   To increase the RF frequency by one step, press and release UP. To slew the RF frequency higher press and hold UP. The frequency will move up one step, pause, and then step higher in frequency at the same rate as if the unit were sweeping.

5. Step or Slew Down:

   Single steps or frequency slew to a lower RF frequency can be obtained by using DWN.

NOTE

The Down slew is much slower than the Up slew to allow for the application of a hysteresis pulse at every step. For a rapid slew in the Down direction, the continuous SWEEP mode should be used.

NARROWBAND CONTINUOUS SWEEP (F ±ΔF)

1. Set controls as follows:

MODULATION	OFF
MODE	F ±ΔF
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Enter desired frequency as shown under CW Signal Generation.

3. Adjust sweep width:

Turn ΔF clockwise until desired sweep width is obtained. The output signal is sweeping at a 1-kHz rate above and below the phase-locked center frequency displayed on the LED readout. Linearity is guaranteed to ±0.1% of Center Frequency; however, much wider deviations may be obtained. If the ΔF is set too wide so that it sweings the output signal into the tracking filters, the RF Power Meter will indicate a decrease in output power.

4. Manual stepping of narrowband continuous swept signal:

The narrowband swept signal may be stepped manually over any or all of the 0.1 to 26 GHz band using UP or DWN.

F ±ΔF Mode may also be used with Single Sweep Mode.

MEASUREMENT OF EXTERNAL RF POWER

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	EXT

2. Connect external signal to EXT RF IN. Do not exceed +15 dBm (31.6 mW).

3. Enter approximate frequency of external signal as covered under CW Signal Generation. This assures best accuracy in making external power readings by using the power meter correction factors contained in the memory of the 1204.

NOTE

The power level of the WJ-1204 output signal is maintained at the level indicated by the PWR display before the select switch is thrown to EXT, provided that the UNLEVELED indicator is not lit, and the display is greater than -10 dBm.

4. Greater accuracy of external power meter readings may be obtained by calibrating the WJ-1204 at the particular frequencies of interest.

MEASUREMENT OF INSERTION LOSS OR GAIN

1. Set controls as follows:

MODULATION	OFF
MODE	F
PROGRAM/DISPLAY	F
Power Meter Select	INT

2. Set ATTENUATION (dB):

   For insertion loss measurements of cables, filters, attenuators, etc., set to 0 dB.

   For amplifier gain measurements, set ATTENUATION value so that the amplifier output level will fall within +10 dBm to -30 dBm.

   Be sure to set input level low enough so that the amplifier will not be saturated.

3. Set desired frequency as covered under CW Signal Generation.

4. Set LEVEL to 0.00 dBm. Press CAL.

5. Connect unit to be tested between the RF OUT and EXT RF IN connectors. Be especially careful about cable lengths and quality above 12 GHz.

6. Measure unit's loss (or gain):

   Set Power Meter Select to EXT. LED reading indicates the unit's loss (for example, -21.4 indicates that the unit under test has a loss of 21.4 dB). If the LED reading is -30.0 dBm or lower, set the Power Meter Select to INT. Adjust LEVEL control clockwise to increase the signal into the unit under test. Read the LEVEL (+4.7 dBm, for example). Set the Power Meter Select to EXT. Read the level (-27.4 dBm, for example, indicates the unit being tested has an insertion loss of 32.1 dB).

   CAUTION

   Be sure to CAL the meter. Do not sweep unit when measuring insertion loss or gain. The frequency may be raised or lowered one increment at a time by the UP or DWN control.

USING THE WJ-1204-1 WITH A CHART RECORDER

1. Follow the procedure for either Continuous Sweep or Single Sweep modes to establish sweep parameters.
2. Connect rear panel PEN LIFT output to PEN LIFT input on Chart Recorder.
3. Connect front panel SWEEP OUT connector to HORIZONTAL input of Chart Recorder.
4. Connect RF OUT connector to Unit Under Test.
5. Connect output of UUT to Crystal Detector covering the appropriate frequency range.

CAUTION

Be sure that the RF power level is low enough to avoid damaging the detector.

6. Connect the output of the Crystal Detector to the VERTICAL input of the Chart Recorder.
7. On the WJ-1204 keyboard press RST. Use the chart recorder controls to position the pen at the left edge of the paper.
8. Program the WJ-1204 to the Stop Frequency by pressing the appropriate digits followed by ENT. Use the recorder controls to position the pen at the right edge of the paper.
9. Repeat Steps 7 and 8 until the pen moves smoothly from the left edge to the right edge and back.
10. Slowly increase the RF power using the LEVEL control and the ATTENUATION control until the pen is midway between the top and bottom edges of the paper.
11. Vary the LEVEL control ±1 dB in both directions and observe pen movement.
12. Use the VERTICAL GAIN and OFFSET controls of the Chart Recorder to obtain the desired sensitivity.
13. Repeat steps 11 and 12 until proper sensitivity is obtained.
14. For Single Sweep, press CLR 8 simultaneously.
15. For Continuous Sweep, set MODE to SWEEP.
16. After pen retraces, set MODE to F.

SELF TESTS

1. DETERMINATION OF PHASE LOCK

a. Set controls as follows:

MODE	$\boxed{\text{F}}$
PROGRAM/DISPLAY	$\boxed{\text{F}}$
MODULATION	$\boxed{\text{OFF}}$
POWER METER SELECT	$\boxed{\text{INT}}$
INCREMENT	$\boxed{\text{1 MHz}}$
LEVEL	$\boxed{\text{MAX}}$ (CW)

b. Program to 2 GHz; press $\boxed{\text{2}}$ $\boxed{\text{ENT}}$.

c. Using $\boxed{\text{UP}}$, single step the frequency from 2 to 4 GHz. If the synthesizer is unlocked, RF POWER Display will read lower than 0 dBm.

2. DETERMINATION OF F ±ΔF OPERATION

a. Set controls as follows:

MODE	$\boxed{\text{F}}$
PROGRAM/DISPLAY	$\boxed{\text{F}}$
MODULATION	$\boxed{\text{OFF}}$
POWER METER SELECT	$\boxed{\text{INT}}$
LEVEL	$\boxed{\text{MAX}}$ (CW)
ΔF	$\boxed{\text{MAX}}$ (CW)

b. Program to 18 GHz; press $\boxed{\text{1}}$ $\boxed{\text{8}}$ $\boxed{\text{ENT}}$.

c. Read RF POWER Display.

d. Set MODE to $\boxed{\text{F} \pm\Delta\text{F}}$.

e. RF POWER Display reading should decrease considerably if F ±ΔF generator is functioning normally.

WJ-1204-1 OPTIONS

1. IEEE 488 BUS (option AB)

   See User's Note WJ-1204-1 Standard Bus Interface.

2. 115/230 V ac OPERATION (Option AC)

   Be sure to check the ac line select circuit card located below the fuse compartment. (See Preliminary Setup, paragraph 1)

3. VARIABLE PRF (Option AD)

   The period of the square wave and pulse modulation as well as the rate of the F ±ΔF generator may be manually controlled via a front panel potentiometer. PRF's may be specified covering 2 decades from 10 Hz to 500 kHz. A switch at the full ccw position provides a fixed 1-kHz rate.

   NOTE

   The F ±ΔF function may not operate normally at rates other than 1 kHz.

4. ALTERNATE LOW FREQUENCY SOURCE (Option AF)

   Option AF allows the operator to select either the internal synthesizer of the WJ-1204-1 or an external frequency source covering 100 to 1000 MHz (minimum). Selection is accomplished via a rear panel toggle switch. An SMA female connector is also provided on the rear panel for input of the External Frequency Source.

   Connect External Frequency Source to SYNTH IN jack (rear panel).

   Set SYNTH switch to $\boxed{\text{EXT}}$.

   Press $\boxed{\text{CLR}}$ and hold while pressing $\boxed{4}$ to display approximate input frequency.

   To obtain exact input frequency:

For Output	Divide Output By	To Get Input
0.1 to 1 GHz	1	0.1 to 1 GHz
1 to 2 GHz	2	0.5 to 1 GHz
2 to 4 GHz	4	0.5 to 1 GHz
4 to 8 GHz	8	0.5 to 1 GHz
8 to 16 GHz	16	0.5 to 1 GHz
16 to 26 GHz	32	0.5 to 1 GHz

4. continued

Program External Source to proper input frequency.

All modulation and level control functions are still available.

Sweep modes and F ±ΔF mode are not available while using the External Frequency Source.

If External Source has frequency coverage below 100 MHz, output can still be obtained.

Press $\boxed{0}$ $\boxed{.}$ $\boxed{1}$ $\boxed{\text{ENT}}$

Press $\boxed{\text{CLR}}$ and hold while pressing $\boxed{9}$.

Program External Source to desired frequency.

Step Attenuator remains in signal path.

All other WJ-1204 functions are disabled.

To return to a frequency in the range 0.1 to 26 GHz, program the desired frequency.

To use normal WJ-1204 synthesizer, set SYNTH switch to $\boxed{\text{INT}}$.

NOTE

Option AF may also be controlled remotely via IEEE-488 bus. See User's Note.

5. 26 TO 40 GHz FREQUENCY EXTENSION (Option AH)

This option provides an additional chassis (3½" high) housing a power amplifier and frequency doubler. A front panel switch will select either NORMAL or HIGH F modes. To obtain frequencies from 26 to 40 GHz, throw the switch to $\boxed{\text{HIGH F}}$ and program the WJ-1204 to half the desired output frequency. The desired output will be available at the waveguide output port. To use the WJ-1204 in its standard configuration, throw the switch to $\boxed{\text{NORMAL}}$ and program the desired frequency.

NOTE

Frequency step sizes are doubled (i.e., 2, 20, 200 MHz) over the entire range from 26 to 40 GHz.

Output power in the 0.1 to 26 GHz range will be decreased by about 2 dB. To obtain full WJ-1204 output, remove the semi-rigid cable and use the 1204 output directly.

6. UNCALIBRATED FM (Option AJ)

Provides for external frequency modulation of the fundamental oscillator via a rear panel input connector. Bandwidth (3 dB) extends from 50 kHz to at least 10 MHz. Provides FM modulation in Continuous Sweep Mode (not available on standard unit). Peak-to-peak input signals should not exceed 5 volts.

NOTE

Deviation sensitivity will vary with programmed frequency.

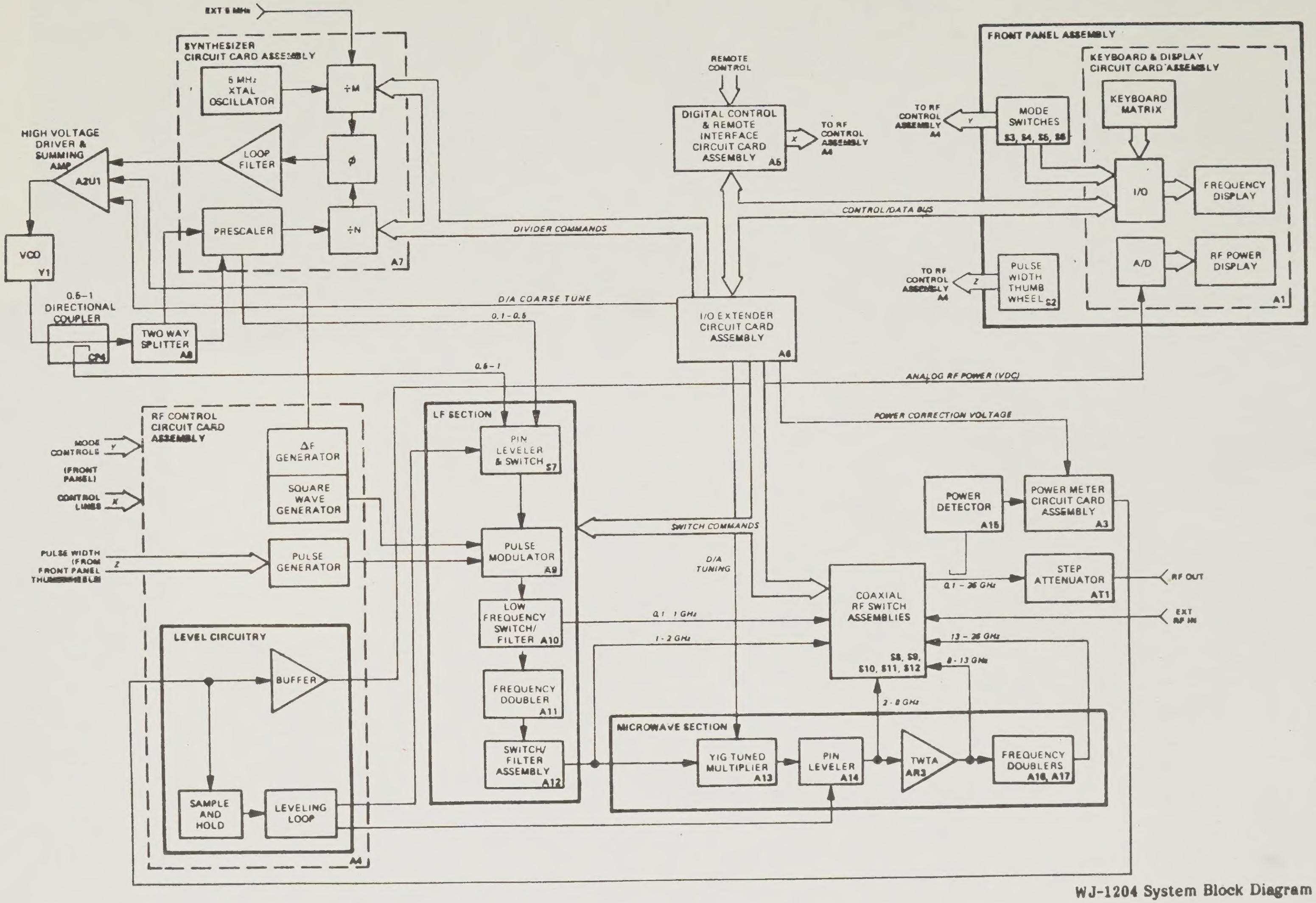
7. EXTERNAL LEVEL CONTROL

a. VERSION 1: Provides rear panel connector and toggle switch for inputting analog voltage (0 V to -2.5 V) to control RF power level.

   Set switch to EXT LEV .

   Input analog dc voltage level to control power level.

b. VERSION 2: Provides external level control from 0 dBm to -10 dBm (minimum) via IEEE-488 remote interface. Inputting data word and control character programs internal D/A converter to control RF level from 0 dBm to -10 dBm (minimum) in 0.1 dB steps.



WJ-1204 System Block Diagram

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